

~~CONFIDENTIAL~~

Memorandum 6M-3345

COPY NO 1 OF 145 COPIES

Division 6 Lincoln Laboratory
Massachusetts Institute of Technology
Lexington 73, Massachusetts

SUBJECT: BIWEEKLY REPORT FOR 28 JANUARY 1955
To: Jay W. Forrester
From: Division 6 Staff

CLASSIFICATION CHANGED TO:
Auth: DD-254
By: XK&
Date: 3-21-60

COVER SHEET

This document is issued for internal distribution and use only by and for Lincoln Laboratory personnel. It should not be given or shown to any other individuals or groups without express authorization. It may not be reproduced in whole or in part without permission in writing from Lincoln Laboratory.

The research reported in this document was supported jointly by the Department of the Army, the Department of the Navy, and the Department of the Air Force under Air Force Contract No. AF 19(122)-000.

This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, (Title 18 U.S.C. Sections 793 and 794). Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

~~CONFIDENTIAL~~

Memorandum 6M-3345

Page 1 of 53

Division 6 - Lincoln Laboratory
Massachusetts Institute of Technology
Lexington 73, Massachusetts

SUBJECT: BIWEEKLY REPORT FOR 28 JANUARY 1955

To: Jay W. Forrester

From: Division 6 Staff

Approved: John B. Bennett
John B. Bennett

CONTENTS

Section I - System Test & Planning	3
Section II - AN/FSQ-7	16
Section III - Advance Development	37
Section IV - Central Services	48

INTRODUCTION

College Recruiting Program

(R. J. Horn, Jr.) (UNCLASSIFIED)

Itineraries

<u>Representative</u>	<u>College</u>	<u>State</u>	<u>Date</u>
W. I. Wells	U. of Iowa	Iowa	24 Jan.
	U. of Nebraska	Nebraska	25 Jan.
	Kansas State College	Kansas	26 Jan.
	U. of Kansas	Kansas	27 Jan.
	U. of Missouri	Missouri	28 Jan.
W. Lone, D. R. Brown	Seattle	Washington	17 Jan.
	U. of Washington	Washington	17 Jan.
	Reed College	Oregon	18 Jan.
	Oregon State	Oregon	19 Jan.
	U. of Oregon	Oregon	19 Jan.
	U. of Idaho	Idaho	20 Jan.
	Washington State College	Washington	20 Jan.
	Gonzaga	Washington	21 Jan.
	Montana State	Montana	24 Jan.

This document is issued for internal distribution and use only by and for Lincoln Laboratory personnel. It should not be given or shown to any other individuals or groups without express authorization. It may not be reproduced in whole or in part without permission in writing from Lincoln Laboratory.

The research reported in this document was supported jointly by the Department of the Army, the Department of the Navy, and the Department of the Air Force under Air Force Contract No. AF 19(122)-458.

This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, (Title 18 U. S. C. Sections 793 and 794). Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

Memorandum 6M-3345

Page 2

E. Rich, C. Zraket	U. of N. Carolina	N. Carolina	24 Jan.
	Duke	N. Carolina	24 Jan.
	Emory	Georgia	25 Jan.
	Georgia Tech	Georgia	25 Jan.
	Alabama Polytech	Alabama	26 Jan.
	U. of Florida	Florida	27 Jan.
	U. of Miami	Florida	28 Jan.
W. Attridge, S. Manber	Rensselaer Polytech	New York	19 Jan.
	Union	New York	19 Jan.
	Williams	Massachusetts	20 Jan.
	Mount Holyoke	Massachusetts	21 Jan.
	Smith	Massachusetts	21 Jan.
C. Grandy, H. Boehmer	Colorado A & M	Colorado	20 Jan.
	U. of Colorado	Colorado	20 Jan.
	U. of Denver	Colorado	21 Jan.
	U. of New Mexico	New Mexico	24 Jan.
	U. of Arizona	Arizona	25 Jan.
	Utah State	Utah	27 Jan.
	U. of Utah	Utah	27 Jan.
	Brigham Young	Utah	28 Jan.
E. Wolf, F. Irish	U. of Akron	Ohio	25 Jan.
	Ohio State	Ohio	28 Jan.

Remarks

These preliminary trips have been made thus far in the college recruiting program. The preliminary phase should be almost entirely completed by the end of the next biweekly period. The response has been so satisfactory that the follow-up trips--the giving of technical talks and actual interviewing--will be a program of similar magnitude. The current staff allotted to this work is insufficient. It appears necessary to enlist the aid of the personnel group to handle many of the arrangements and also to borrow personnel within Division 6.

~~CONFIDENTIAL~~

Memorandum 6M-3345

Page 3

I - SYSTEM TEST & PLANNING

1.1 Air Defense1.1.2 Cape Cod System Operation

(W. E. Ball, Jr.) (CONFIDENTIAL)

The weapons-assignment display which I have been preparing for the past month is complete and is being readied for checkout prior to incorporation into the 1954 CCS. It is hoped that final checks can be made during the week of 31 January.

(E. Bedrosian) (CONFIDENTIAL)

The tracking-simulation program has been checked out.

The records for this program which are required for the 1954 Cape Cod System computer-program documentation have been completed.

(A. E. Budd) (CONFIDENTIAL)

The program I was asked to write has been delayed until the specifications are complete.

In the meantime I have been writing an indoctrination problem and reading the SAGE manuals.

(L. B. Collins) (CONFIDENTIAL)

I have recently been assigned to the XD-1 Programming Section under the direct supervision of Mr. H. D. Benington and have started work on a storage-block-display utility program for the 1954 Cape Cod System.

(R. Davis, A. Smalley, P. Dolan, A. Hill) (CONFIDENTIAL)

Test Coordination Sub-Section scheduled three standard demonstrations, three Raydist orientation tests, one special-equipment checkout, and two training tests.

Five strike aircraft were scheduled and flown for the first demonstration. Three interceptions were attempted using FPS-3 data. These were unsuccessful because of Mark X and computer-program malfunctions. Five strike aircraft were scheduled and flown for the second demonstration. Despite the unreliability of Mark X, three intercepts were completed successfully. For the third demonstration five strike aircraft were scheduled, but because of unavailability of aircraft only two became airborne. Four intercepts were attempted, but Mark X jitter, the failure of Montauk to show returns in S. Truro's mapped-out area, and failure of S. Truro to operate on mode three resulted in unsatisfactory intercepts.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3345

Page 4

UNCLASSIFIED

Of the three Raydist orientation tests, one was cancelled in order that a study could be made of the S. Truro Mark X difficulties. A B-29 was flown to check Mark X. Two Raydist tests were flown as scheduled. In both tests tracking was difficult, particularly in the S. Truro area where neither Montauk nor the gap fillers supplied data. Results of one test were fair, the second reasonably good.

The special-equipment check was scheduled, primarily, for Mark X confirmation. During the morning checkout Mark X returns seemed to be operating satisfactorily, but the equipment failed when computer time became operational. A few minutes prior to computer release time the Mark X became operative and appeared to be functioning satisfactorily.

Both training tests were conducted as simulated training tests. Two data-link interceptors were scheduled to fly during the operation of one of the tests, but power failure at the monitor station cancelled the data-link program checkout.

(H. Frachtman) (CONFIDENTIAL)

The recording program has been checked out and seems to be operating satisfactorily. A memorandum on this will be issued soon.

Planning for the data-generation program has begun.

(F. Gucker) (CONFIDENTIAL)

During the past biweekly period the digital displays (DD's) for the Identification Stations were checked out. Also a more detailed DD was programmed for interceptors on combat air patrol or return to base. Most of my remaining effort has been devoted to detailed documentation of all DD's in the 1954 Cape Cod System. Documentation should be completed early in the next biweekly period.

(W. Harris) (CONFIDENTIAL)

I have recently been assigned to the SAGE System Planning Section, and, pending issuance of SECRET clearance, I am programming radar-system design problems for Group 31.

(I. B. Hazel) (CONFIDENTIAL)

During the past biweekly period it has been necessary to make major changes in two of the situation-display programs because of the addition of the weapons-assignment display. This major change and other smaller modifications and improvements will be checked out over the weekend. During the next biweekly period all changes will be incorporated in the final copy of each program, and the flow diagrams will be completed.

~~CONFIDENTIAL~~

UNCLASSIFIED

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3345

Page 5

(J. Ishihara, D. Bailey, F. Brooks) (CONFIDENTIAL)

Documentation of the tracking programs for the 1954 Cape Cod System is now nearing completion. Up-to-date program copies are available for all programs, and most flow diagrams are in final form. This work should be completed during the next biweekly period.

Several days during this period were devoted to preparations for CCS demonstrations and participating in guiding activities.

(D. Latimer) (CONFIDENTIAL)

During the first week of this last biweekly period, I completed two programs. These programs were written as indoctrination problems to learn to use all the in-out facilities of WWI. During this second week I have been trying to check out these programs along with a program using scope display which I had written previous to this biweekly period.

(S. Manber, R. Smith) (CONFIDENTIAL)

The equipment-check program detected trouble in the extinguishing circuit for the indicator-light registers. This condition has been reported to T. Sandy (Group 64). The new 1954 Cape Cod Equipment Notebook will be completed during the next week. R. Smith is being indoctrinated in operation of the TBS room equipment. S. Manber is operating Cape Cod System for the purpose of learning the tracking program and the checking out of new modifications to this program.

(A. Mathiasen, B. Stahl) (CONFIDENTIAL)

Trouble with the Raydist program converting hyperbolic coordinates to Cartesian coordinates has been traced to an improperly selected counter in the programmed-arithmetic section. The program is now operating, and we will process all existing Raydist tapes. The program has been modified slightly to allow automatic height input at any point of a run.

On 28 January the flight plan for the Raydist mission was temporarily changed to one giving better tracks for the gap fillers. A fairly successful run was obtained with about half of the radars, so it may be possible to orient these radars at last.

Reasonably good data was obtained on 26 January from Truro.

On 31 January and 1 February we shall be at the Raydist plant in Virginia primarily to discuss an automatic digitalizer for counting Raydist cycles and punching the information out on IBM cards. If such a device is practical, it will eliminate the present long wait from a mission until results are ready. We shall also discuss the problem of the earth's curvature which, combined with ground-wave transmission of Raydist signals, distorts the assumed hyperbolas into non-Euclidean hyperbolas. A third topic of discussion will be the determination

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3345

Page 6

of lane count when no zero orbit is executed by the tracked aircraft. This will allow the use of Raydist on "realistic" interceptions without requiring anything special in the way of a Raydist maneuver.

The memo concerning the use of Raydist in radar calibration has been revised and should be ready for issue shortly.

(L. J. Murray) (CONFIDENTIAL)

The bulk of the past biweekly period has been spent at the Barta Building operating the 1954 Cape Cod System

Some time has been devoted to considerations of the syllabus for the 1954 Cape Cod System Indoctrination Program which will be conducted from 23 February 1955 to 9 March 1955.

(W. Vecchia) (CONFIDENTIAL)

	<u>hr</u>	<u>min</u>
Total Assigned Time	126.5	
Extra Assigned Time	<u>15.5</u>	
	142	

	<u>hr</u>	<u>min</u>
Analysis	27	20
Tracking	32	10
Weapons Direction	38	45
Raydist	11	45
Equipment Check	3	
Combined		
Tracking	27	30
Weapons Direction		
TOTAL	140	30

Time Given to 6345	1	
Time Lost to Computer (malfunction)		30
	<u>1</u>	<u>30</u>

	140	30
	<u>1</u>	<u>30</u>
GRAND TOTAL	142	

~~CONFIDENTIAL~~
UNCLASSIFIED

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3345

Page 7

1.1.3 XD-1 Programming

(S. Hauser, F. Garth) (CONFIDENTIAL)

The pretest phase of the XD-1 manual-input experiment which we have conducted thus far has yielded the following results:

1. When data is received by telephone, transcribed, and then card-punched, the transcription should be done on special cards, one card per report, with the data arranged in the best possible way for rapid and accurate punching.

2. O26 operators must be skilled before any reasonable speed of input can be assured. Because of the frequent use of numerical keys, there appears to be no appreciable carryover from typing skill to O26 operating skill.

3. In the design of the program card, we have decided on the basis of the preliminary test to consistently program "alphabetics" for those fields containing both alphabetic and numerical information.

4. The detailed card design we have done for three categories of input seems adequate for the purposes of the test.

At present we are recruiting 6520th AC&W personnel who will serve as transcribers and O26 Card Punch and O56 Card Verifier operators. If the recruiting goes according to schedule, we will begin testing within a week.

(P. Vance, E. McEvoy) (CONFIDENTIAL)

The present start-over program has been documented and is being modified to synchronize Raydist timing with the "start-over" time of the Cape Cod System.

The final start-over program has been written and partially checked out with a parameter tape. A more comprehensive parameter tape will be prepared to complete preliminary checkout. The final checkout will be made with the operational system.

(E. Yienger, C. Gaudette, S. Knapp) (CONFIDENTIAL)

On 15 January the following programs were run on the 701 computer at IBM in New York City, using the XD-1 simulation program:

1. Sine-cosine subroutine. This program was checked out.
2. Trace program. The major portion of this program was checked out, but minor modifications remain to be made.
3. Training problem. Some program errors were found.

~~CONFIDENTIAL~~
UNCLASSIFIED

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3345

Page 8

A proposal for XD-1 utility programs (6M-3306, C. Gaudette, 18 January 1955) has been written and distributed. The specifications for these programs will be issued jointly by IBM and MIT in the near future. Two other memos, one on card-preparation procedures and one on regulations governing the Card Room and the Computer Room, are being written.

1.1.4 SAGE Planning

(W. S. Attridge, Jr.) (CONFIDENTIAL)

Personnel requirements for the operational preparation of the P-1 Direction Center have been revised to conform with the target date of 1 March 1957. The net effect has been to squeeze 7 weeks out of a 7-month period by increasing manpower by 50%.

I am preparing installation dates for external-communications facilities for the P-1 Direction Center.

(J. J. Cahill, Jr., A. G. Favret) (CONFIDENTIAL)

On 19 January 1955 we visited Bell Telephone Labs at Whippany, N.J., with J. Arnow, Group 61, H. Rising, Group 64, and H. White, IBM. We discussed the Lincoln proposal for integrating AA with SAGE with members of the Ground Weapon Systems Division of BTL. Additionally, we discussed the technical feasibility of converting from standard SAGE 1300 pulse per second transmission to BTL's 750 pps AN/TSQ-7 transmission at some intermediate point between the SAGE Direction Center and the AA batteries with a representative of the BTL group working on AN/TSQ-7 development. The major results of these discussions are contained in a memo from Arnow, Favret, and Cahill to C. R. Wieser.

On 25 January 1955 representatives of G. L. Martin Co. who have been working on the Signal Corps' Project 444-A for coordinated antiaircraft defense visited Lincoln. We discussed the SAGE System and problems of AA integration with them and learned that Martin is reexamining Project 444-A. We reported on the meeting in a memo to J. Arnow.

On 28 January 1955 we briefed Battery Commanders of the Fifteenth Group, AAA, on SAGE and AA integration. Col. P. Stiness requested the briefing so he could sample the Battery Commanders' reactions and report them to Army Antiaircraft Command (ARAACOM). Col. Stiness is CO of the Fifteenth Group and ARAACOM's Liaison Officer at Lincoln.

(H. Peterson, A. Shoolman) (CONFIDENTIAL)

The draft of Memorandum 6M-3330, tentatively titled "Auxiliary Console and Wing Unit Equipment Specification and Layout for AN/FSQ-7 Direction Centers," is being revised to agree with latest information concerning availability of manual-input, warning light, and audible-alarm bits.

~~CONFIDENTIAL~~
UNCLASSIFIED

~~CONFIDENTIAL~~

Memorandum 6M-3345

Page 9

UNCLASSIFIED

1.1.5 SAGE Training

(S. Hibbard) (CONFIDENTIAL)

On 19 and 20 January I met with the training group for ADES at New York, and we reviewed the proposed training requirements and phasing schedules for the SAGE System in preparation for the final Training Subcommittee Meeting to be held in New York 28 January.

It appears at this time that the training of personnel for the first Subsector can be accomplished satisfactorily at XD-1. The obvious problems at present are lack of a classroom for briefing and debriefing, housing for personnel under instruction, what organization will furnish instructors, whether instructors (military personnel) can be stabilized for length of training period, etc.

1.1.6 Test Program Planning

(D. R. Israel) (CONFIDENTIAL)

A goodly portion of time has been devoted to getting the college recruiting campaign under way. This appears to have been accomplished.

The major items of the test program covered in the past bi-weekly period have been (1) a survey of what is to be accomplished in the study of the initiation process and (2) the design of initial tests to provide initial information on track monitoring and tracking accuracy. The program for initiation is indicated in 6M-3303, "Initiation Studies and Tests." The track-monitoring and tracking-accuracy tests have been written up in inter-office memo form, prior to further discussion and publication as M-notes.

On Thursday and Friday, 27 and 28 January, Messrs. Ennis, Herckmans, and Olmstead of BTL visited the Laboratory to discuss the progress on the test program. A detailed list of problems to be considered in the four general areas of (1) data characteristics, (2) radar-data input, (3) initiation, and (4) tracking is under joint preparation. The next step, to be carried out the week of 31 January, will be the preparation of time schedules listing these items.

(W. Z. Lemnios) (CONFIDENTIAL)

The weapons-assignment program has been written and is now being checked out.

A proposal has been made for the evaluation of the track-monitoring function by the measurement of suitable tracking variables.

A study of tracking accuracy by means of Raydist is continuing.

~~CONFIDENTIAL~~

UNCLASSIFIED

~~CONFIDENTIAL~~

Memorandum 6M-3345

Page 10

UNCLASSIFIED

(J. Levenson) (CONFIDENTIAL)

A draft of the specifications for the first set of tests in the study of track initiation has been distributed for comments and corrections. A tentative time schedule has been made for all the tests planned to collect data on track initiation, and it indicates that the study will not be completed before the end of June.

The description of the 1954 Cape Cod System recording program by H. Frachtman was studied and some corrections and additions made. A memo with the final specifications for the recording program will be issued in the near future.

(J. F. Nolan, E. Wolf) (CONFIDENTIAL)

Specifications have been formed for a series of simulated tests to measure the effectiveness of the tracking-monitoring process in the 1954 Cape Cod System. Simulated SDV data for B-29 aircraft from the South Truro FPS-3 will be introduced into the System with varied combinations of monitor and tracking-program action.

1.1.7 Analysis and Simulation

The Manned-Interceptor Simulation

(H. D. Neumann) (CONFIDENTIAL)

The manned-interceptor simulation program (MISP), including the evaluation section, has been completed. Initial runs will be made during the week of 31 January.

(E. Smulowicz) (CONFIDENTIAL)

The data-evaluation program for the manned-interceptor simulation has been written and is being checked out.

(H. D. Houser) (CONFIDENTIAL)

Three days were spent obtaining coefficients for the difference equations describing the aircraft response to a commanded change in heading for the MISP.

~~CONFIDENTIAL~~

UNCLASSIFIED

~~CONFIDENTIAL~~

Memorandum 6M-3345

Page 11

UNCLASSIFIED

Charactron Display

(H. D. Houser) (CONFIDENTIAL)

The input and conversion program for generating display on the MTC Charactron tube has been checked out. The display program has been modified to give dynamic display with variable repetititon rates.

Help on Radar Design

(H. D. Neumann) (CONFIDENTIAL)

One-thousand runs were made with the F-99 simulation program for the study of radar quantization vs. radar scan rate. Eight-thousand more runs will be made during the week of 31 January.

Numerical Evaluation of Markov Processes

(C. Friedman) (CONFIDENTIAL)

The program to compute the response of first-order Markov processes is completed and will be checked out during the week of 31 January.

~~CONFIDENTIAL~~

UNCLASSIFIED

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3345

Page 12

1.2 Whirlwind I1.2.1 Cape Cod System Engineering

(E. S. Rich) (CONFIDENTIAL)

The first opportunity to critically evaluate the Mark X radar data as it is received by the computer occurred during the week of 17 January. During the demonstrations on 18, 19, and 20 January the data displays were monitored and photographed simultaneously at the radar, at the Lexington display room, and at the computer. A major defect observed was an erratic shift in azimuth, most noticeable at the longer ranges, which made computer tracking unsatisfactory. At a conference of representatives from Groups 22, 23, 61, and 64 on 21 January, it was pointed out that the erratic behavior probably results from use of the 8-bit azimuth pulse generator which is a part of the SDV equipment instead of a 12-bit azimuth generator. It was agreed that Group 23 would immediately undertake the installation of a temporary 12-bit azimuth generator in order that more reliable data will be available for the demonstrations the week of 15 February. By that time the final system will be completed by the shop and ready for installation.

1.2.2 WWI System OperationRecords of Operation

(M. F. Currier, B. H. Jacobs) (UNCLASSIFIED)

The following is an estimate by the computer operators of the usable percentage of assigned operation time and the number of computer errors for the period 13-27 January 1955:

Number of assigned hours	204
Usable percentage of assigned time	99
Usable percentage of assigned time since March 1951	89
Usable percentage of assigned time since September 1953	93
Number of transient errors	7
Number of steady-state errors	1
Number of intermittent errors	2

Analysis of WWI Failures

(A. R. Curtiss) (UNCLASSIFIED)

The following is a breakdown of interrupting and potentially interrupting failures occurring in the WWI computer system for the bi-weekly period, 14-27 January 1955, inclusive:

~~CONFIDENTIAL~~
UNCLASSIFIED

Total Number of Failures 16
Total Number of No-Lost-Time Failures 2
Total Number of Lost-Time Failures 14
Total Lost Time in Hours 2 1/4
Total Operating Time in Hours 286

Class of Failure	Chargeable to System			
	Explainable		Unexplainable	
	No.	Min. Lost	No.	Min. Lost
Tubes	1	0		
	1	20		
Fuses			1	0
	1	5		
Alarms				
	6	49	4	20
Miscellaneous				
	2	45		
Number of Lost-Time Incidents	10	119	4	20
Number of No-Lost-Time Incidents	1		1	

(A. Roberts, L. Holmes, D. Morrison) (UNCLASSIFIED)

The computer reliability for this period reached a new high of better than 99%. Half of the 16 interrupting incidents were the result of core-memory parity alarms. The nature of these alarms indicates that one bank of digit-plane drivers may be sensitive to power transients.

A new mode of operation will be added to the marginal-checking equipment on 29 January. This mode of operation will allow the program to select a line and hold either the positive or negative excursion for any desired length of time.

Power Supplies

(E. W. Pughe, Jr.) (UNCLASSIFIED)

Each tube of the series-tube sections in the WWI -60-v, -450-v, and +200-v power supplies has had 10-ohm parasitic suppressor resistors installed in the plate circuits. Also 120,000-ohm resistors were installed in the grid circuits of these tubes to limit the grid current in case of a fault in the grid driving circuit.

~~CONFIDENTIAL~~

Memorandum 6M-3345

Page 14

UNCLASSIFIED

In connection with the new WWI filament alternator drive motor, which will also be used to regulate the laboratory a-c, there is a possibility that the time constant introduced by the power transformer bank being in the closed loop will cause difficult stability problems.

(J. Ackley) (UNCLASSIFIED)

Work has begun on a consolidated test program for the equipment in Room 156. The program will be similar in form to the present consolidated test program for the central computer.

A proposal is being prepared for two new instructions for Whirlwind. These instructions, partial sum and identity check, will enable logical programs to be coded with ease.

1.2.3 Terminal Equipment

Data Inputs

(A. V. Shortell, Jr.) (CONFIDENTIAL)

Telephone Circuits. Conversion of data circuits to the new specifications has been made by the telephone company during the past biweekly period. Changeover to the new terminal equipment at Cambridge on Saturday, 29 January, will complete the conversion of these lines. The improvement in the transmitted signal has been very good, especially in the case of the Nantucket site from which we have never received a useable signal.

As a result of a meeting with representatives of Group 22 and the telephone company on 19 January, liaison between these groups and our Section has been improved considerably.

Teletype Circuit. The teletype circuit to Beavertail Point, Jamestown, R. I., is now operational. The trouble was at our end of the line rather than at the Navy end as had been reported.

Nantucket Data. As a result of the improvement in Nantucket's phone-line signal, an effort has been made to provide Nantucket data for Group 61. Thanks to Bill Glass and Paul Grant for a superb job of expediting the construction of a phone-line demodulator, this data will be available on Tuesday, 1 February, a week ahead of schedule.

Mark X Data. Mark X equipment at South Truro has been modified to reduce azimuth jitter and improve the precision of azimuth data. The modification is still being debugged.

Fairchild Camera for Mapping Monitor. Al Smith and Loren Prentice of Group 60 Engineering Section, with the assistance of Lloyd Sanford,

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3345

Page 15

have undertaken a design for the camera mount. Redesign of the control circuits has lagged behind during the past 2 weeks but will be expedited the week of 31 January.

(C. S. Lin, L. D. Healy) (UNCLASSIFIED)

The demodulator auxiliary for MITE 2 has been modified to compare with that for MITE 1.

MITE 16 has been tested with the buffer drum and is ready for operation.

During the next biweekly period, a second buffer-drum status channel will be converted to use gate writers.

Indicator-Light Registers

(T. Sandy) (UNCLASSIFIED)

During the checkout of the equipment in Room 222 on 27 January 1955, one of the registers failed to clear properly. This failure seems to be due to a marginal condition of the registers and is occurring at this time because of normal deterioration of the registers. This failure only occurs when all eight registers are selected consecutively.

5-Inch DuMont Scopes

(T. Sandy) (UNCLASSIFIED)

The slow time-constant variation (2 to 30 seconds) observed on the two scopes I am testing has been traced to V103 of the vertical amplifier.

This variation has the strange characteristic of appearing only when the scope has been in continuous use for a period of from 3 to 4 days.

Typewriter and Paper Tape

(L. H. Norcott) (UNCLASSIFIED)

Three punches have been equipped with modified die blocks and oversize cam rollers. These punches satisfactorily perforate uncoiled gray tape which is opaque, shears cleanly, and has good resistance to tearing, but which is too tough for unmodified punches. We plan to incorporate the above modifications in the rest of our punches.

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3345

Page 16

SECTION II - AN/FSQ-7

2.1 System LiaisonData-Transmission Equipment

(A. P. Kromer) (UNCLASSIFIED)

Information has been gathered and a presentation prepared for the Air Force Joint Project Office concerning the advantages of Air Force rental of DDR-DDT equipment for the SAGE System communications network. ADC has expressed concern because rental costs quoted by AT&T Co. are somewhat higher than had been hoped. The benefits, both immediate and long range, which will result from Bell System responsibility for the entire communications network are being summarized for further consideration by USAF Hq. organizations, who will shortly make a final decision in this matter.

AN/FSQ-7 (XD-1) System

(A. P. Kromer) (UNCLASSIFIED)

Group 62 Systems Office is developing a program covering the work to be done and a schedule for this work to bring into being the experimental SAGE Subsector of which XD-1 is the center. Consideration is being given to having the PCO provide a follow-up service in connection with this program. This action will thus provide a strong background for PCO use in dealing with coordination of similar matters in the production-system program.

Exhibit AFCRC-17

(P. J. Gray) (UNCLASSIFIED)

At a meeting in Lexington on 27 and 28 January, agreement was obtained among Lincoln, IEM, and AFCRC as to the contents of Exhibit 17. A previous meeting was held in New York, at which the various interested Air Force agencies agreed on their requirements. As a result of these meetings, AFCRC has indicated that Exhibit 17 will be published in final form by them sometime during the week of 31 January.

Exhibit AFCRC-55-18

(P. J. Gray) (UNCLASSIFIED)

Finalization of Exhibit AFCRC-55-18 (formerly AFCRC-18) describing the AN/FSQ-8 has been scheduled to follow Exhibit 17 by 2 months.

Memorandum 6M-3345

Page 17

~~CONFIDENTIAL~~
UNCLASSIFIED

It is now believed that this schedule may be bettered by a considerable amount.

Remote-Location Study

(P. J. Gray) (UNCLASSIFIED)

Additional background material has been collected on the various remote locations involved in the SAGE System. Information being collected for each location includes: current method of operation, probable mode of operation with SAGE, and specific problems needing attention. A write-up will be prepared for review of the information by BTL and Lincoln for the purpose of determining which remote locations have problems requiring a significant amount of study. It is expected that BTL will submit a proposal to the ADES Project Office concerning a study of these locations by that organization.

2.2 XD-1, XD-2

2.2.1 Systems

Sage Experimental Subsector Planning Committee

(H. E. Anderson, I. Aronson,
J. H. Newitt, H. J. Platt) (CONFIDENTIAL)

An activity has been started which has as its purpose the over-all monitoring, planning, and coordination of the SAGE Experimental Subsector.

The people involved in this activity are in the midst of forming a modus operandi. As the first step, this group is consolidating and issuing the presently agreed-upon Experimental Subsector schedule data.

Auxiliary Memory

(R. P. Mayer, W. A. Clark, J. Mitchell,
N. T. Jones, R. D. Buzzard) (UNCLASSIFIED)

The study group described in the last biweekly completed the study as planned. R. Mayer and B. Housman visited Poughkeepsie on Thursday, 20 January, to discuss the auxiliary-memory proposals with LIM production and drum-memory groups. A verbal report and a written summary were presented to people concerned in a meeting in J. W. Forrester's office on 21 January. This meeting was announced in 6M-3304.

The decision was to add a special drum frame approximately 25 feet long for additional auxiliary memory. This decision is briefly reported in 6M-3323. The full report of the study group will be published as a memorandum in the very near future.

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3345

Page 18

R. Mayer and B. Housman wrote the proposed specifications for this drum frame as memorandum 6M-3328. These specifications were reviewed with IBM at Poughkeepsie on 27 January by Mayer and Housman.

Data-Circuit Patch Panel

(I. Aronson) (UNCLASSIFIED)

I have just finished writing a rough draft of "Proposed Specifications for the Data Circuit Patching Console." This will be issued as Memorandum 6M-3000, Supplement 12, probably during the week of 31 January.

Auxiliary-Memory Review

(P. R. Bagley, B. G. Farley, L. R. Jeffery) (CONFIDENTIAL)

We have been asked to make, with the following objects in mind, a 1-month study of the problem of providing additional FSQ-7 memory:

1. To become familiar with the air-defense program in order to be in a better position to evaluate future change requests from Group 61;
2. To determine the precise amounts of extra memory needed for XD-1 and the FSQ-7 duplex and to recommend an interim solution to meet the needs of XD-1;
3. To predict memory requirements for possible future additions to the system, such as Bomarc and AAOC.

Maintenance-Requirements Study

(P. R. Bagley, B. G. Farley, L. R. Jeffery) (UNCLASSIFIED)

We are writing the results of our study concerned with the predicted reliability of XD-1 and the duplex center and the consequent requirements on maintenance procedures, particularly on maintenance programs. This will be published in the near future as 6M-3341, "Maintenance Requirements for FSQ-7 Based on Predicted Computer Performance."

Specifications for FSQ-7

(P. R. Bagley, R. P. Mayer) (UNCLASSIFIED)

As part of the effort to prepare a set of documents defining the complete specifications for FSQ-7, we have written two M-notes: 6M-3291, "Specifications for the Central Computer System for the AN/FSQ-7," and 6M-3292, "Specifications for the Drum System for the AN/FSQ-7."

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

Memorandum 6M-3345

Page 19

Compatibility of LRI at XD-1 with Various Inputs(H. E. Anderson, A. D. Hughes,
J. P. May, A. M. Werlin) (CONFIDENTIAL)

Memorandum 6M-3333, "Proposal for the Modification of the XD-1 LRI Equipment to Provide for the Acceptance of Production-Type of P-site Phone Line Signal," and Memorandum 6M-3334, "Proposal for the Modification of the XD-1 LRI Equipment to Provide for the Acceptance of Phone Line Data from South Truro," were written. These describe the work necessary in changing the original design of the equipment and show the resultant drum words as they will appear in XD-1.

XD-1 Communication System

(H. J. Kirshner, C. J. Carter) (UNCLASSIFIED)

An initial order has been placed for the XD-1 internal-telephone system. A copy of this order is contained in 6M-3000, Supplement 2. The current traffic diagram for the XD-1 internal system is available in 6M-3000, Supplement 1. A description of facilities for telephone recording and monitoring will be available in 6M-3000, Supplement 3, which is to be published next week. The assignment of dial-exchange stations is available in 6M-3000, Supplement 8. A description of the public-address system to be installed in Building F is contained in 6M-3000, Supplement 10. Maintenance intercom-station layout is available in 6M-3000, Supplement 9.

2.2.2 InstallationXD-1 Installation Information - Report #27 (Extract)(W. Kates, H. Mercer,
P. Morrill, H. Wainwright) (UNCLASSIFIED)

I. Building Construction - see Section IX, below.

II. Schedules

The latest summary schedule was issued on 28 January. It shows that work under contract to IBM is progressing satisfactorily but that work under the Air Force contract is running behind our realistic schedule by an average of 2 to 3 weeks. The Air Force work is running behind by an estimated 2 to 3 months if the contract completion date of 13 December 1954 is used.

III. Power Equipment

The PCD amplidyne-control section arrived from IBM on 19 January and was moved into place on 20 January. Cabling to this section will be tied in on 29 January.

~~CONFIDENTIAL~~

Memorandum 6M-3345

Page 20

IV. Equipment Cooling

The contractor estimates completion of equipment-cooling installation will be in about 6 weeks. Test and balancing of the system will be later.

V. Cabling and Method of Distribution

B. Cabling

1. Job I (power wiring for all power equipment) - essentially complete (see Section III, above).
2. Jobs II and III (power wiring) - cables have been pulled into place to all five MCD frames; cables are now being pulled into place for the DCPD frame (display-console power distribution).

With the exception of the tape-adaptor frame, power-module wiring has been prefabricated for the remaining frames, drum, display, and manual-input sections, on the first floor west.

3. Job IV (central-computer frames) - signal cables running between the drums and central-computer frames are on hand but will not be installed before the drum frames arrive (now scheduled for 1 March).

IV. Equipment Layout

IBM basement - architectural drawings are being prepared by Cleverdon, Varney & Pike.

Second floor - Francis Associates are preparing architectural drawings of the projection room.

VII. Lighting

Almost all of the fixed-level lighting has been installed on the first floor. If the louvered ceiling for the second floor arrives by 31 January, the contractor says he will be off the job by about 8 February.

VIII. Telephones

During this reporting period, temporary "house" telephones were installed throughout the entire building.

IX. General

True occupancy in the sense of MIT's maintaining the areas of the building accepted for "beneficial occupancy" by the AF was challenged

Memorandum 6M-3345

Page 21

when we learned that the Laborer's Union objected to Division 1's sweeping and moving desks. A series of meetings during the week of 24 January resulted in MIT's arranging for maintenance of these areas by an independent contractor who would be compatible with the trade unions still on the job. Thus a possible strike was averted.

Late Flash!

As a result of a meeting with Major Dupay of the Air Installations Office and another meeting with the general contractor, Mr. Wainwright reports that the second floor west, except corridors and Room P will be ready for "beneficial occupancy" on 4 February. The balance of the building, except corridors, will be ready by 11 February and corridors by 18 February. These dates are conditioned by possibly excepting lighting in some areas and barring unforeseen subcontractor delays.

Telephone Installation

(C. J. Carter) (UNCLASSIFIED)

Temporary dial-telephone service consisting of 16 stations off of the Bldg. F PBX was installed in Building F mainly to assist IBM in setting up and testing their equipment. At the same time, other cabling was run throughout Building F so that as other IBM equipment arrives or as other parts of the building are occupied, telephone service can be installed within 24 hours. These temporary telephones will be used until the XD-1 communication system is operating.

The NET&T has begun installation of communication facilities for XD-1. A distribution frame is being installed, and house cables are being run at present. Some difficulty was encountered because of a misunderstanding as to where these cables should be located, but this has been resolved.

Light-Testing Room - B-034

(W. H. Ayer, E. L. Smiley) (UNCLASSIFIED)

Group 38 is continuing Characteron readability experiments.

We have installed fixtures for blue lights to test selective-filtration schemes.

A CFS-6B radar scope has been installed in the room so that we may make lighting tests for radar rooms.

Results of a study are now available that show that four additional electronic frames (total power dissipation of 60 kilowatts) may be installed on the office floor if certain modifications are made.

Memorandum 6M-3345

Page 22

Reduced-size equipment-layout drawings were made of the basement, first floor, and second floor of Building F. It is intended that these drawings will show the pieces of equipment as they are installed in the Building. The drawing numbers are B-75081, B-75082, and B-75076.

2.2.3 Testing

(J. A. O'Brien) (UNCLASSIFIED)

The operation of our XD-1 testing activity is getting a little clearer as time goes on.

We have completed the specifications for the initial evaluation tests to be performed on XD-1, and we have drawn up a time schedule of our spec-writing activities. We are now studying the drum and display systems prior to writing specs for their performance in the machine.

A machine-time allocation schedule has been drawn up in consultation with interested parties. This schedule will serve as a basis for weekly schedules.

The testing of the machine in Bldg. F is proceeding quite well.

The central computer, including the card reader, is all assembled and operating. The printer is being tested now, and the punch is scheduled to be included during the week of 3 January.

The marginal-checking equipment is not operative yet, but it should be by the week of 31 January. We hope then to start routine marginal checking in order to establish the margins as soon as we can.

There has been some difficulty with pushbutton controls that seems to have been caused by oversize pulses and some crosstalk. Shielded cables will be installed in these signal lines.

A program of tube replacement is under way to get rid of many tubes which were poorly based but for which there were not replacements. Half of the offending tubes have been replaced.

(W. J. Canty, J. D. Crane, S. L. Thompson) (UNCLASSIFIED)

Three memoranda which describe XD-1 tests have been published. The first, Memorandum 6M-3317, "Evaluation Tests on the XD-1 Central Computer," contains a general outline of information to be included in each evaluation test. Specific details of an evaluation test scheduled for 28 February 1955 are included in 6M-3326, "Central Computer Evaluation," and similar information regarding an evaluation test scheduled for 1 March 1955 can be found in 6M-3332, "Central Computer Evaluation No. 2."

Memorandum 6M-3345

Page 23

A special program, mentioned in Memorandum 6M-3326, to test the card reader and punch has been written.

An outline of XD-1 test continues, and a test specification which includes the planned use of MTC for the display system is now complete.

At present, evaluation tests for the drum system on XD-1 are being formulated.

D-C Supplies

(S. Coffin, J. Clark) (UNCLASSIFIED)

A 50-kw test load has been constructed and is being used to test the XD-1 d-c supplies. We expect that we will be able to report the results of the first series of regulation tests in about 2 weeks.

Power System

(A. Chopourian) (UNCLASSIFIED)

A preliminary check is being made to determine where the wiring diagrams submitted by Westinghouse do not agree with the actual wiring in the switchgear cubicles. As soon as the electrical contractor is finished with his work, Division 7 personnel will ring out the questionable circuits and correct the drawings. Manufacturers of switchgear do not issue exact wiring diagrams. Selection of the termination is left to the discretion of the wiring technician so long as the functional operation remains the same. An exact wiring diagram will reduce down time by facilitating trouble shooting and circuit changes. Future orders will call for the exact wiring diagram which carries a small additional cost.

The switchgear has recently been running on a 16-hour-per-day basis without any shutdowns caused by faulty operation of equipment. Control relays on the PCD frames have caused difficulties when coming on. This appears to be a problem of keeping the relay contacts dust free.

A letter has been sent to IBM outlining the various troubles encountered when operating the switchgear and the PCD frame as a unit. The major fault seems to be the improper use of signals between the two units.

Memorandum 6M-3345

Page 24

2.3 Production System

(S. H. Dodd) (UNCLASSIFIED)

A review of the documents specifying the AN/FSQ-7 has been under way for the past 2 weeks. A series of nine M-notes, each covering a major portion of the AN/FSQ-7, is in the final stages of preparation. The intent of these memoranda is to list the specification documents with supplementary material which may be used for the preparation of an initial contract and which are sufficiently firm to justify the initiation of manufacturing procedures.

Unresolved items have been listed in separate sections and indicated as changes. Some of these changes are considered necessary before the equipment is considered capable of performing adequate air defense, but they were included as changes because the solutions are not known in sufficient detail for either inclusion in a fixed-price contract or the starting of production engineering.

A new Section of Group 64 is being organized to be called the SAGE Technical Liaison Section. It will be the objective of the Section to accumulate existing schedules and planning material for the SAGE System and to fill in the gaps in these activities between areas of responsibility of the various cooperating organizations.

(C. W. Watt, Jr., R. Jeffrey, K. E. McVicar) (UNCLASSIFIED)

A SAGE Technical liaison Section of the Systems Office has been proposed. This Section would have both planning and scheduling responsibilities. The planning activity would consist of assembly of a job outline and goal definitions for the SAGE System and the development of the implications of the work done at the Experimental Subsector where this work affects the SAGE System. The scheduling activity would consist of the accumulation of schedules generated by the responsible organizations and the assembly of this information in a summary form. This summary would then be a central information clearing house for Lincoln groups.

It is proposed that this Section should be manned by personnel from Groups 62 and 64 on a full-time basis. In addition, part-time assistance will be needed from members of Group 61 and Division 2.

A memo is being written for the purposes of describing this proposal in detail.

(R. H. Gould) (UNCLASSIFIED)

Memos 6M-3300 and 6M-3309 have been written defining, respectively, the specifications of the maintenance equipment and the warning-light system of the AN/FSQ-7 production system.

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3345

Page 25

2.3 Production System

(H. L. Ziegler) (UNCLASSIFIED)

Conclusions and recommendations resulting from a study of field-maintenance testing of pluggable units are given in Memo 6M-3319 just issued. Contents of this memo were discussed at a 20 January Poughkeepsie meeting with J. D. Hood of IBM.

I am now investigating methods and equipment to aid in the isolation of sources of intermittent or transient-type failures.

(T. R. Parkins) (UNCLASSIFIED)

C. Zraket, W. S. Attridge, Jr., and I made a survey of display-console types and quantities needed at Kingston test cells for checking partial operational programs.

R. Mildram (Div. 2) and I wrote a tentative FGD system delivery and test schedule for K. E. McVicar's Subsector 1 schedule.

C. A. Rice (IBM) and I have agreed upon a posting technique for the IBM Duplex Frame Schedule, an unposted copy of which I received on 27 January. This schedule will be posted for the first time on 1 February 1955.

Input and Output Equipment for Subsectors 1 and 2

(H. J. Platt) (CONFIDENTIAL)

Memorandum 6M-3267-2, "Recommended Quantities of Input and Output Equipment for the First and Second AN/FSQ-7's," has been written and sent to the Duplicating Room. The numbers of channels of input and output equipment, which can vary from subsector to subsector, are determined for the first two AN/FSQ-7's.

Crosstell Inputs

(H. J. Platt, R. C. Jeffrey) (UNCLASSIFIED)

Responsibility for the crosstell-input element has been taken over by J. P. May, A. D. Hughes, and A. M. Werlin (see "Automatic Input Elements," below).

UNCLASSIFIED
~~CONFIDENTIAL~~

~~CONFIDENTIAL~~
UNCLASSIFIED

Memorandum 6M-3345

Page 26

Automatic Input Elements

(H. Anderson, A. Hughes, J. May, A. Werlin) (CONFIDENTIAL)

Memorandum 6M-3301, "Specifications for Automatic Input Elements of AN/FSQ-7," was written to specify the functions required in the long-range-radar-input (LRI) element, the gap-filler-input (GFI) element, and the crossteling-input (XTI) element. This memorandum is to be used as the subject of a TIR specifying the equipment to be constructed, and it gives a statement of the priority of known and anticipated changes.

Gap-Filler Inputs (GFI)

(H. Anderson, A. Hughes, J. May, A. Werlin) (CONFIDENTIAL)

In conjunction with the study of the IBM GFI equipment and the gap-filler radar-site equipment, a visit was made to IBM to observe and discuss with the IBM engineers the operation of the GFI mapper. A data circuit from Lexington to Poughkeepsie was installed on 28 January 1955 and is being checked by Div. 2 personnel. A meeting will be held in Lexington on 1 February 1955 to work out a schedule for transmission of data from Lexington to Poughkeepsie over the recently installed data circuit.

Long-Range-Radar Inputs (LRI)

(H. Anderson, A. Hughes, J. May, A. Werlin) (CONFIDENTIAL)

The new specifications, 6M-3276, for this equipment have been published and distributed to obtain concurrence from all parties concerned. All letters of concurrence should be received by 1 February 1955. The justification of these specifications is being written as a separate memorandum and will be published shortly.

Output System

(H. Rising, M. Feldstein, S. Ginsburg) (CONFIDENTIAL)

During the last biweekly period drafts of the specifications for the manual-inputs and output systems have been written. These documents are almost in their final form.

Interleaved digital-data messages will be used for crossteling and height-finder messages, because the receiving equipment has already been designed. Other users will be able to use interleaved messages, or noninterleaved messages if another ground-to-ground output section is added.

UNCLASSIFIED
~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum 6M-3345

Page 27

A thorough analysis of the output system, which has been designed by IEM, is being completed. The characteristics of other users, the MX-1179 for example, are being analyzed for possible inclusion in the SAGE System.

D-C Supplies

(J. J. Gano) (UNCLASSIFIED)

A meeting was held on 19 January at the G. E. plant in Lynn, where the supplies will be assembled and tested. Since the -48-v supplies will not have batteries, it is expected that three cubicles of the size used in the XD-1 will house one set of voltage units. Since each of the units has a smaller capacity than XD-1, there will be a number of units in each cubicle. A 1600-cps motor-generator set will serve as a frequency multiplier instead of the magnetic unit of XD-1.

The physical arrangement of components in the cabinet holding the 90-v and -150-v supplies works out very neatly. The arrangement when four voltage units are installed in one cabinet does not work out too well. The components are distributed by type rather than by grouping according to voltage unit, rendering trouble shooting difficult. This arrangement was dictated mostly by the restriction imposed by the air-conditioning designers on the amount of air flow through a cabinet. Coffin and I suggested a panel-type construction for the amplifier section whereby they might be able to satisfy both the air-conditioning and trouble-shooting recommendations. The G. E. people thought it would be worth investigating, but the IEM group did not encourage them for fear of causing a delay in the scheduled delivery to Kingston.

Switchgear

(J. J. Gano) (UNCLASSIFIED)

G. E. has been awarded the contract for the nine motor-generator sets and associated switchgear that are to be installed at the Kingston test cells. A meeting was held at Philadelphia with groups from the transformer section of Pittsfield, the motor-generator section of Fort Wayne, and the switchgear section of Philadelphia. Delivery was scheduled for 10 weeks after receipt of order. Because of the time lag in processing the order at IEM, it is now hoped that delivery will be made in 7 weeks in order to meet the Kingston schedule. The G. E. groups think they can just meet it.

Major discussions on protection of the generators and on the regulators took place. IEM specified a maximum of protection for the generators. As a result, the cost of the protective equipment was greater than the cost of the generators. A compromise was substituted for the Kingston equipment. The protective equipment will now cost about 10% of the generator cost and will handle about 60% of the faults. I am having Jackson and Moreland make some calculations in order to determine whether

~~CONFIDENTIAL~~

Memorandum GM-3345

Page 28

or not we already have sufficient protection in our current-overload and voltage detectors.

For the regulator of the generator output voltage, the problem was one of selection between a magnetic amplifier with a permanent magnet generator and a d-c exciter with an electromechanical regulator. The magnetic-amplifier system has the advantage of reduced maintenance due to the elimination of exciter brushes and moving parts in the electromechanical regulator. The difference in cost, however, is large, about \$30,000 for an installation. A compromise for the Kingston equipment uses a magnetic amplifier on the generator supplying the filaments only. This equipment reduces the size of motor necessary for cycling the a-c. G. E. had quoted on this compromise. A decision for the production units has been deferred.

Power Distribution

(G. F. Sandy) (UNCLASSIFIED)

Interlocks for the protection of the electronic equipment in the event of an air-distribution system failure were discussed with the IEM power group. They agreed to provide this protection.

Three power documents were agreed upon with IEM; the concurrence letters for these documents should be ready for signatures on 1 February. These documents are: D48-1, "Duplex PCD (Power Control and Distribution) Frame"; D64, "Simplex PCD Frame"; and D62, "Duplex Input MCD (Marginal Checking and Distribution) Frame." Only one document remains for the complete specification of the power-distribution system for the production machines. This document is D33-1 and is a change to D33, "Marginal Checking System." IEM has been asked to write two more documents that, while not necessary for the power-system specification to the machine, should be written for record purposes. These documents will cover the power module of the load frames and the power-switching unit in the display consoles. These should be completed within 4 or 5 weeks.

GM-3297, "Power Conversion and Distribution," by J. J. Gano and myself, gives the complete list of documents that specify the power-conversion and distribution system for AN/FSQ-7.

2.4 Vacuum Tube Circuits

Pulse Test vs. Pulse Performance

(B. Barrett) (UNCLASSIFIED)

Fourteen 7AK7's were tried in a Mod. A pulse amplifier (PA) to measure the effectiveness of the acceptance pulse test for 7AK7's.^A In this test the plate current is noted when the control and suppressor grids are driven to +10 volts. Although the amplifier satisfied the input-output transfer requirements for all tubes, the output-pulse amplitude showed

Memorandum GM-3345

Page 29

poor correlation with the acceptance-test currents.

Pulse Amplifiers

(B. Barrett) (UNCLASSIFIED)

A report on the pulse performance of the A_{PA} , B_{PA} , and C_{PA} has been written.

Phone-Line Demodulator and Modulator

(E. B. Glover) (UNCLASSIFIED)

All marginal-check curves for both the demodulator and the modulator have been completed and checked. A few minor corrections must be made. The curves will then be turned over to the Document Room to be processed for inclusion in the M-note that is to be written.

Flip-Flop, Model A

(N. J. Ockene) (UNCLASSIFIED)

The performance of the Model A high-speed flip-flop using simulated 40% down 22177 tubes indicates that the circuit tends to free-run when low-level triggers are employed. One configuration which partially rectified this defect made use of a silicon diode between grid and cathode circuits. This raised the minimum trigger level for complementing action to 4 volts at 200-kc prf and 6 volts at 2-mc prf. A bias buildup was noted across the silicon diode when 2-mc prf triggers of large amplitudes were employed. These effects, which might possibly impede triggering action when a series of large triggers is followed by a low-level trigger, will be investigated further.

Another circuit configuration using a separate biasing source was also successful in reducing the effects of random triggering at low trigger levels. The effects of bias buildup with large-amplitude triggers in this configuration is now being investigated.

Sensing Amplifiers for Memory Planes

(R. C. Zopatti) (UNCLASSIFIED)

The newly developed input transformer has been installed in the Mod. IV MTC sense amplifier; because of the decreased gain of the transformer, the cathode degeneration in the first stage of the amplifier was removed, thereby increasing the over-all gain of the amplifier. The screen voltage of this first stage then had to be reduced to 90 volts to stay within the allowable screen dissipation of the tube. The unit will now be tested in MTC.

Memorandum 6M-3345

Page 30

The breadboard model of a modification of the Mod. IV MTC sense amplifier is now being built. The first stage of the Mod. IV MTC sense amplifier has been replaced by a dual triode which permits two stages of amplification instead of a single pentode stage and limits the amplitudes of the inhibit and post-write-disturb pulses.

2.5 Display

(C. L. Corderman, J. I. Woolf) (UNCLASSIFIED)

We made a trip to IBM's Vestal Laboratories and checked the console as far as possible. This unit will arrive in Lexington on 7 February where it will be installed in MTC for further tests.

The display tester has a mode of operation which differs from that planned in XD-1. The tester is set so that the Charactron is normally intensified and then blanked between traces. It is advisable to operate the tube as planned in XD-1, that is, normally blank and then intensify. We are considering with Jim Holmes the methods of accomplishing this.

(R. J. Callahan, B. M. Gurley) (UNCLASSIFIED)

A large percentage of our time is now being spent in planning the assembly and frame test of the situation-display-generator frame, which is due to arrive in approximately 6 weeks.

(R. S. Fallows) (UNCLASSIFIED)

Work on the central display frames has been concerned with cleaning up the frame-logic drawings and preparing for frame testing. I understand that the first of our frames (frame 25) will arrive in the next period.

(R. H. Gerhardt) (UNCLASSIFIED)

I wrote Supplement 4 for "Specifications for AN/FSQ-7 (XD-1) Display System" (6M-2877, Confidential). This Supplement, when concurred upon, will allow mixing of display-assignment bits and will specifically require mixing of basic categories.

I have started regular trips to Poughkeepsie (two each week) for conferences on systems tests for the display system. IBM has assigned one programmer familiar with system tests to work full time on the activity and a second programmer to work half time. In addition, a third man from E. Goldman's group will work part time on system-test planning.

Memorandum 6M-3345

Page 31

(R. B. Paddock) (UNCLASSIFIED)

I am finally receiving information on the mechanical specifications of an auxiliary console so that design of the display-tester console can now be completed.

A good deal of time is now being spent in acquiring an understanding of both the digital-display logic and the digital-display-tester logic for use in indoctrinating a test crew.

Situation-Display Camera Control and Mount

(L. L. Sutro) (UNCLASSIFIED)

Entire responsibility for the design of the situation-display camera control and camera mount is now in the hands of MIT. A month ago John Walsh of Vestal Lab. had indicated that the responsibility was theirs. However, we continued our work, resulting in a block schematic of the system (D-61622), agreement with Dick Best on the vacuum-tube circuits to be used, and tentative agreement with the components group at High Street on the ten relays to be used. Several needed relays not used before in XD-1 are being tested by this components group. The camera-control system is expected to occupy six pluggable units in frame 25. Layout of the pluggable units will start the week of 31 January. Loren Prentice will start the design of the camera mount during the same week.

(J. I. Woolf) (UNCLASSIFIED)

Plug-in unit 6483 arrived this week. This unit completed the vector generator's complement. In debugging this unit, several wiring mistakes and faulty components showed up. However, this showed that the assembly drawings were correct. After debugging the vector generator, I started to check the margins of operation within the circuit. The sweep generator showed a prf sensitivity when repeating vectors every 150 microseconds. This problem will be pursued further, and then complete marginal-check information will be taken on the vector generator.

Drawings for the compensation inhibit, selection decoders, and associated line drivers in MTC have been released.

(H. E. Zieman) (UNCLASSIFIED)

All expected engineering changes have been completed on the display line-driver amplifier and character-selection decoders. Marginal-check data is now being compiled. A slight change was made in one of the marginal-check lines to differentiate between failures in two groups of tubes which had previously been checked simultaneously.

Memorandum 6M-3345

Page 32

(A. Grennell) (UNCLASSIFIED)

Status of drawings and drawing releases:

	<u>Frame 24</u>	<u>Frame 25</u>
Etched-card drawings released to IBM	100%	100%
Pluggable-unit design released to IBM	100%	100%
Logic drawings completed	100%	100%
Logic drawings released to IBM	0	90%
Frame drawings completed	100%	100%
Frame drawings released to IBM	100%	100%
Pluggable-unit test specs and test-adaptor designs released to IBM	100%	100%

Status of experimental pluggable-unit construction and type testing:

Ordered through Production Control	100%	100%
Construction completed	97%	95%
Type test completed	69%	71%

Memorandum 6M-3345

Page 33

2.6 Vacuum Tubes2.6.1 Activities of Group 65

(P. Youtz) (UNCLASSIFIED)

J. S. Palermo and I spent the past fortnight at the Convair Charactron Tube Plant. Convair did not meet their first delivery commitment to IBM on 19-inch Charactron tubes. Since we have always been able to make 19-inch Charactron tubes regularly at the Barta tube laboratory, we studied the Convair processes and practices to carefully note the discrepancies between their practices and ours. At this date they have not made any tubes that meet all of IBM's specifications. However, they are rapidly getting all of their processes under control, and production of tubes that meet all of IBM's specifications may start during the next fortnight.

2.6.2 Tube Research and Development

(S. Twicken) (UNCLASSIFIED)

A progress meeting on the DT-438 (improved 5998) was held with the Project High Tube Group at Tung-Sol. The first stage of the program involving the setting up of a line, revamping an exhaust machine, etc., is nearing completion. Samples of possible anode redesigns (a necessity) should be available in February.

Work on the construction and assembly of two pulse-characteristic testers for the Barta and Lexington tube shops is nearing completion. Barring difficulty in procurement of meters, the units should be in operation during the next 2 weeks.

The 2420/7AK7 polycasting program is ready for final tube casting and measurement. Various casting resins have been tried and techniques for handling and casting a considerable number of tubes worked out.

Discussions were held with the Project High Tube Group and Dr. Germeshausen of Edgerton, Germeshausen, and Grier relative to the marginal checking of thyratrons. In agreement with comments of other people with whom the problem has been discussed, it may be possible to get an indication of gas pressure without removing the tube from its socket, but a practical means of checking on the cathode without removing the tube has not yet been proposed. With careful circuit design reducing gas cleanup to a minimum, cathode evaporation may be the limiting factor in long life. An examination of WWI 2D21 failures after long life will be made to determine whether this is so.

I attended a meeting of the ASTM Interface Impedance Subcommittee. Standards describing equipment and method of test are being prepared for submission to JETEC and the industry.

Memorandum 6M-3345

Page 34

(T. F. Clough) (UNCLASSIFIED)

RCA confirmed our life-test findings of interface impedance in their type 5963. It was stated that this condition existed, inadvertently, during a few months' production on their computer tubes, because their cathode-sleeve vendor had changed the composition of the cathode nickel. This condition has been corrected, and production since then is reported to be free of interface impedance. Life tests will be run on a lot of 5963's recently received.

I attended two conferences with the Project High Tube Group at the DuMont Tube Research Laboratory in Passaic, New Jersey. The first was held to discuss the K-1303 (improved K-1211 photomultiplier) specifications and future plans; the second to review some mount-construction details which were in need of improvement. DuMont discussed the steps they have taken to improve the K-1303.

G. A. Avarbock of Group 62 began working with the Lexington Section during this period. He will be trained on tube-test procedures so that our Division will be prepared to handle whatever tube-test load XD-1 will require from us.

(L. B. Martin) (UNCLASSIFIED)

F. L. Holmes of IBM is making production tests on three Typotron tubes with the 16-position life test. A shortage of convergence coils has prevented the simultaneous testing of these tubes. Leakage tests made by Holmes on the three tubes show that all failed at least one test.

Almost full time is being devoted to writing a master's thesis proposal. The thesis will cover the life test and evaluation of the Typotron tube.

The following is a list of Typotrons, their condition, and total hours on life test:

<u>Tube</u>	<u>Total Hours</u>	<u>Condition</u>
265	6941.6	marginal
280	6123.6	satisfactory
335	5306.6	satisfactory
366	4604.8	satisfactory
389	4521.0	satisfactory
390	4604.8	satisfactory
392	4604.8	satisfactory
394	3822.7	marginal

Memorandum 6M-3345

Page 35

(P. C. Tandy) (UNCLASSIFIED)

The five 19-inch Charactrons on life test, CHT-61, CHT-62-1, CHT-74, CHT-75, and CHT-80, now have operating times ranging from 896 to 2408 hours.

At the last testing period CHT-62-1, CHT-75, and CHT-80 had shown no appreciable change in pulse-matrix or pulse-cathode currents. CHT-62-1 has shown a slight drop in matrix and cathode currents between 1974 and 2249 hours on life. This drop will not be considered significant unless the change continues. The pulse-beam current of CHT-74 has dropped from 70 to 28 microamperes at zero bias between 836 and 1111 hours on life. The transfer-characteristic curve of this tube also developed a dip in the pulse-matrix current curve over the same period. The tube has been operated at zero bias d-c for the last 761 hours.

(D. C. Lynch, J. S. Palermo) (UNCLASSIFIED)

During the past 2 weeks emphasis of the chemical laboratory has been on the polycasting of receiver tubes, deposition of various phosphors, and sintering of cathodes.

In the polycasting of receiver tubes a technique for the filling and baking of these tubes has been developed.

Xerography studies have made necessary the investigation of techniques for the deposition of various phosphors. Some of these tubes have been processed and are ready for testing.

Several dispenser-type cathodes have been sintered and passed along for processing in vacuum tubes and evaluation.

2.7 Memory Test Computer

(W. A. Hosier) (UNCLASSIFIED)

Operation has continued with about the same reliability and distribution of time as previously. Some difficulty has been experienced with the +250-v supply, but it is anticipated that this will be overcome when a new amplifier is installed in this supply about 1 February.

A panel of diode gates and cathode followers was installed on accumulator digits 5-15, inclusive, to permit simulation of XD-1 feature and category controls when the IBM prototype Charactron console arrives during the week of 31 January. This was checked and seems to perform as desired.

It has been decided to improve the MTC display systems (console and camera scopes, as distinct from Charactron) to permit better photographing

Memorandum 6M-3345

Page 36

and more accurate point plotting. To this end, two CR tubes, type K1187 P11 metallized, have been ordered from DuMont so that the P11 phosphor may be used for photographing instead of the less efficient P2 phosphor. Also, layout is proceeding for new ten-bit decoders and line drivers of the type designed by Zieman and Woolf for XD-1, which will give a symmetric output of 200 volts plate to plate instead of the present one-sided 4-v output. In addition, the mounting hood of the camera on this 12 1/2-inch scope is being rebuilt to give a bigger picture and better focus.

Panels have been delivered by the shop to complete the card-machine circuitry, and the next biweekly period should see this wired in and checked.

Magnetic-Drum Memory

(J. McCusker, E. Gates) (UNCLASSIFIED)

Eight fields of magnetic-drum memory are now available for general use. The fields are numbered consecutively from 3 through 10.

Card Machine

(F. R. Durgin) (UNCLASSIFIED)

All the necessary assemblies for the full construction of the card-machine circuits have been received. These will be connected to the machine and tried out during the week of 4 February. The card machine may be available for use starting 14 February.

Power Supplies

(R. Jahn) (UNCLASSIFIED)

A defective Sensitrol relay has been shutting off the d-c supplies immediately after the "power on" button is pushed. The instrument-repair shop will find out what the trouble is and will examine all other Sensitrols for possible similar defects.

Analysis of MTC Tube & Component Defects

(E. Albanese) (UNCLASSIFIED)

<u>Tube or Component</u>	<u>Defect</u>	<u>Number</u>	<u>Hours Lost</u>
5965	Low plate current	1	0
5965	Shorted	1	0
6AU6	Gone to air	1	0.1
6080	Gone to air	1	0
6080	Heater defect	1	0
6145	Grid emission	1	0
			<u>0.1</u>

Memorandum 6M-3345

Page 37

SECTION III - ADVANCE DEVELOPMENT

(D. R. Brown) (UNCLASSIFIED)

Ferrite memory cores are being made in our pilot plant and tested for use in a 256 x 256 experimental memory plane. These cores have better signal ratios and shorter switching times than cores used previously.

Work to develop a ferrite switch core continues at General Ceramics.

Several basic circuits for using the surface-barrier transistor are being evaluated, including three or four flip-flop circuits. The best of these will be selected for construction of an eight-digit multiplier. K. H. Olsen will be responsible for the design and construction of the multiplier.

The first of a series of monthly technical meetings with Philco was held in Philadelphia on 25 January. Specific steps to improve the surface-barrier transistor were listed at this meeting.

3.1 Magnetic Materials

3.1.1 Chemistry

Colton Press

(F. E. Vinal) (UNCLASSIFIED)

A study of progress in tooling and fitting up the Colton memory-core press now indicates that BMS Carbide will deliver the press, tooled and working in eight of the 16 stations, on 1 March. Remaining stations will be tooled at a later date.

Quantity Supply of Memory Cores

(F. E. Vinal) (UNCLASSIFIED)

Cores for the 256 x 256 experimental plane are supplied from batches DCL-2-825 and 826, but further quantity supply for the immediate future will be of the DCL-2-801 type, as this material is less exacting in firing-control requirements than the 2-825 type and equally satisfactory in all other respects.

Efforts to improve memory cores continue. One technique to decrease switching time is now in experimental stages, while another has been outlined but has not as yet commenced. Any success in the planned

Memorandum 6M-3345

Page 38

experiments will not be available for some time in quantity production, and the current 820-ma switching time of 1.0 microsecond will be standard for immediate demands.

Production of Memory Cores

(J. Sacco) (UNCLASSIFIED)

Approximately 50,000 F397 memory cores have been prepared from several firings of batch DCL-2-825. An additional 70,000 cores are pressed and ready for the firing cycle.

Thirty-thousand cores have been pressed from a new batch, DCL-2-826. Test firings indicate that this composition has the same firing cycle as DCL-2-825 but shows improved rectangularity and signal ratios. Two 3-kg batches are now being processed, and the continued pilot-plant production of this type of core is planned.

Ferrites for Magnetostrictive Measurements

(D. L. Brown) (UNCLASSIFIED)

DCL-3-121 to 133 A series, nickel ferrite and nickel-manganese ferrite, was refired.

A considerable amount of time was spent in reading pertinent ferrite literature.

Chemical Analysis

(E. Keith, P. Reimers) (UNCLASSIFIED)

Quantitative analyses of the following have been completed:

1. DCL 2-811, a memory-core comparison;
2. DCL 1-180, a magnesium-manganese ferrite of special composition.

Quantitative analyses of the following are in progress:

1. DCL 2-825, DCL 2-826, DCL 2-827, all memory-core compositions;
2. A sample of General Ceramics 1326B grade S 1 cores.

The accuracy of the analytical methods now in use is being tested by analyzing control samples using these and other methods.

Memorandum 6M-3345

Page 39

Microstructure Study of Ferrites

(F. S. Maddocks) (UNCLASSIFIED)

Firing of series DCL 2-770 through DCL 2-786 has been completed and microstructure data taken. This series is a reexamination of an area in the magnesium-manganese ferrite system where previous data indicated unexpected low values for hysteresis-loop squareness. Comparison of data from this series with that from previous identical series is being made to detect possible changes in microstructure with improved processing techniques.

Cores for 256 x 256 Memory Plane

(J. W. Schallerer) (UNCLASSIFIED)

Fifty-thousand cores have been tested for the 256 x 256 memory plane. Of this figure, 38,000 were accepted, and to date 18,000 of the accepts have been turned over to the Memory Section for plane construction.

It should be pointed out that the above yield figures, indicating a 76 per cent yield, are the result of the application of a more restrictive selection of cores than has been previously used. The self-imposed limits used to select cores for this plane have been:

1. Disturb-zero output less than 35 millivolts at 470 milliamperes, instead of the 45 millivolts permitted by IBM core specifications;
2. Minimum undisturbed-one output at 740 milliamperes must be 80 millivolts instead of 75;
3. Any core whose waveform is unusual or inconsistent but otherwise passes specifications has been rejected;
4. Any core marginal in any respect not previously mentioned is rejected.

Through this high degree of restrictive selection, it is hoped that operating margins in memory use will be further increased while maintaining a reasonably high yield figure (76 percent).

Radar Interference in Core Testing

(J. W. Schallerer) (UNCLASSIFIED)

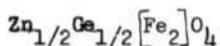
The number of equipment shutdowns due to radar interference has increased greatly during the past 2 weeks. The semiautomatic core tester and the B-H loop tracer were useless for several periods. Work

Memorandum 6M-3345

Page 40

on the automatic core tester has been stopped until screens are installed in the air-conditioned area in B-188.

3.1.2 Physics



(J. B. Goodenough) (UNCLASSIFIED)

The magnetic moment per molecule of $\text{Zn}_{1/2}\text{Ge}_{1/2}[\text{Fe}_2]_0\text{O}_4$ has been measured to be 2.15 Bohr magnetons at room temperature, 3.25 Bohr magnetons at liquid-nitrogen temperature. Although this material does not appear to be ferromagnetic (i.e., with a saturation moment of 9 Bohr magnetons), it is believed that other zinc-germanium compounds may be.

Switching Mechanism

(N. Menyuk) (UNCLASSIFIED)

A study is being made of various fundamental parameters of magnetic materials with respect to their relationship with the switching mechanism. In this study, particular emphasis is being placed upon empirical data presently available. The conclusions based on this work are being written up.

Curie Temperatures of Ferrites

(P. K. Baltzer) (UNCLASSIFIED)

Curie temperatures have been determined for the compositional series with the following general chemical formula: $(\text{MgOFe}_2\text{O}_3)_x(\text{ZnOFe}_2\text{O}_3)^{0.85\beta}(\text{MnO})_y$. The Curie temperature was found to decrease from 250°C to 33°C for $\beta = 0$ and $\beta = 0.65$, respectively. The Curie temperatures for $\beta > 0.65$ are less than room temperature and are yet to be determined. These results are understandable, since zinc ferrite is paramagnetic and thus dilutes the magnetic exchange, which produces ferromagnetism.

Current-Pulse Generator

(J. D. Childress) (UNCLASSIFIED)

The need for a fast-rise-time, high-amplitude current-pulse generator still exists. The two generators which have been built are, unfortunately, not current sources. Therefore, the problem is being tackled again.

The requirement that the generator be a current source dictates that pentodes be used in the output stage. The problem is the

Memorandum 6M-3345

Page 41

drive for the output stage; the brute-force method becomes very expensive for the desired rise time of 0.01 microsecond.

D-C Fluxmeter

(R.A. Pacl, Jr.) (UNCLASSIFIED)

We are in the process of constructing a rack-mounted thermal-log box to be used as a housing for the core and input circuit of the d-c fluxmeter. The present construction suffers from the thermoelectric differential voltage due to changes in ambient temperature. It is hoped that this drift can be reduced to a negligible minimum.

Memorandum 6M-3345

Page 42

3.2 New Components and Circuits

3.2.1 Transistor Circuits

Philco Contract

(T. H. Meisling) (UNCLASSIFIED)

The work to be done by Philco was discussed at a recent meeting in Philadelphia. During the first period, the work will be as follows:

1. Study of high-temperature storage characteristics of the surface-barrier transistor;
2. Study of the influence of geometry changes and germanium-resistivity changes on reverse-recovery characteristics and other characteristics;
3. Study of setting of margins and establishment of marginal-checking procedures;
4. Preparation of recommendations of life tests.

Trip to Westinghouse, Elmira

(D. J. Eckl) (UNCLASSIFIED)

With members of Groups 35 and 24, I visited the transistor-production facilities at the Westinghouse Elmira tube plant. They are at present in pilot production only but have done a considerable amount of applications work.

Trip to BTL, Murray Hill, N. J.

(D. J. Eckl) (UNCLASSIFIED)

I attended a joint services quarterly briefing on transistor progress at Murray Hill on 19 January. Both the pnp and the high-frequency tetrode were discussed. These transistors have potential frequency limits in the 100- to 1000-megacycle region and are accordingly of great interest to us.

Design of Arithmetic Elements

(A. L. Pugh) (UNCLASSIFIED)

An eight-digit stepping register using surface-barrier transistor has been designed and put into operation. As it is double rank, it uses ten transistors per digit. It will be put on life test in the near future.

Memorandum 6M-3345

Page 43

(K. H. Konkle) (UNCLASSIFIED)

During the past two weeks I have measured base-collector characteristics of surface-barrier transistors in an attempt to find an optimum value of load resistance and to provide values for an equivalent circuit to be used in analysis of more complicated circuitry. I have also been investigating the use of silicon diodes as a method of increasing collector swing in these circuits when under load.

Shift Register

(J. R. Freeman) (UNCLASSIFIED)

Operating margins for the two-flip-flop simulated shift-register system have been taken. The circuit operates with 0.35-v triggering pulses with pulse lengths greater than 0.2 microsecond, 0.6-v with 0.1- μ sec pulses, and will operate with pulses as short as 0.05 microsecond if sufficient amplitude is supplied.

Transistor Equivalent Circuit

(E. U. Cohler) (UNCLASSIFIED)

A great deal of work has been done on representing the characteristics of the alloy or surface-barrier transistor in terms of linear approximations. As a result, a good approximation has been found, and it has been found to predict the characteristics of the transistor to a reasonable degree of accuracy. The theory of this approximation, along with a few examples, will be discussed in a future note.

Flip-Flop

(E. U. Cohler) (UNCLASSIFIED)

A new type of flip-flop has been invented with several advantages over former types and few disadvantages. The major feature of this flip-flop which differentiates it from former types is crosscoupling by means of silicon junction diodes. These diodes act like batteries in the circuit and thus speed up the circuit and provide over twice the voltage swing which was previously available. The chief disadvantage of this circuit is a nominal decrease in the load capability of the flip-flop.

Silicon Diodes

As a result of the work on the new flip-flop we have obtained some data on the recovery characteristics of silicon diodes. These data are merely relative and cannot be expressed quantitatively, but they indicate that the Western Electric and National Semiconductor types show greater hole storage in general than other gold-bonded types. The Texas Instruments probably come next in the magnitude of this effect, followed by some

Memorandum 6M-3345

Page 44

experimental models of Raytheon and Transitron. Actually we are looking for diodes with relatively long hole-storage times (greater than 0.25 microsecond in our particular circuit) so that the National Semiconductor types are most suitable for us (the W.E. diodes are not so readily available).

Voltage-Type Decoder

(L. Jedynek) (UNCLASSIFIED)

The ten-channel, voltage-type decoder under investigation employs two identical five-channel stages. The output of the stage which decodes the decimal 0-31 binary input from the counter is reduced in amplitude and mixed with the output from the other stage. This produces a total voltage output corresponding to the decimal 0-1023 binary input. In attempts to increase the speed of the decoder it became necessary to modify and rebuild the original mixing network to reduce and balance out stray capacitances. Preliminary tests have indicated that the transistorized decoder will resolve the smallest increment in the binary input at counter-trigger-input frequencies well in excess of 500 kilocycles.

Thesis

(C. T. Kirk) (UNCLASSIFIED)

My thesis entitled "Investigation of Semiconductor Devices as Gated-Amplifiers for Digital Computers" was submitted to, and accepted by, the Electrical Engineering Department on 21 January 1955.

3.2.2 Magnetic-Core Circuits

Stepping Registers

(P. Griffith) (UNCLASSIFIED)

The week of 17-21 was spent in the testing of diodes in single-core-per-bit and two-core-per-bit stepping registers (using only one stage). The diodes tested (only one of each) were Transitron T-5, S-48, S-82, 1N191, and Hughes 1N68A. The 1N191 diode was slightly superior to the others, and the Hughes diode seemed to be the least desirable. All the other diodes had practically the same characteristics. The number of turns on the input winding was varied from one to two times that of the output winding of the first core. Diode operation was independent of the number of turns on the input winding of the second core in the two-core-per-bit stepping register; however, in the single-core-per-bit stepping register this was not true. Pictures were taken to verify these results.

Memorandum 6M-3345

Page 45

(M. Cerier) (UNCLASSIFIED)

A stepping register can be made by connecting Ramey-type amplifiers in series. A circuit of this type can be designed so that it is symmetrical with respect to each end. Because of this symmetry, this circuit can be used to shift information in either direction. A stepping register of this type is essentially a two-core-per-bit stepping register. The direction in which the information will propagate is determined by the phasing of information pulses with respect to the driving cycle. Information can be fed into the register at both ends, but ONE's will cancel each other when they meet.

3.2.3 Memory

(W. N. Papian) (UNCLASSIFIED)

The first tests of our semiautomatic technique for assembling 64 x 64 unit planes have been encouraging. The first unit took about 2-1/2 technician days to complete; further refinement of apparatus and technique should reduce this time considerably.

A time schedule is being roughed out for the complete 256 x 256 x 34 memory; the terminal date is about 1 year from now. Design goals include a 6- to 7- μ sec cycle time and no more than about 1000 cathodes in the system.

George Hoberg and a delegation from Burroughs visited here. They have a government contract to design, construct, and install two 4096-register, coincident-current core memories of the 20- μ sec-speed class. The use of core switches and slower (lower current) cores is likely.

256 x 256 Memory

(J. L. Mitchell) (UNCLASSIFIED)

A block diagram of the 256 x 256 memory system has been completed and is available as D-47179.

Norton Cushman from Sprague Electric spent a day here discussing the problem of packaging tape-wound magnetic cores. As soon as more cores are available, Sprague will provide us with a number of sample packages for test and evaluation.

A proposal which would eliminate 75% of the soldered connections in the 256 x 256 plane has been presented by J. Raffel and myself and is now under discussion. The main disadvantage of this proposal is that we would be unable to raster-test completed 64 x 64 modules.

A plug-in switch which contains 16 switch cores has been constructed and is now being evaluated. In this unit, two of the four windings through

Memorandum 6M-3345

Page 46

each core are "sewn" type windings. Preliminary results show that in this type of plug-in switch the leakage inductance is 20% less than when the cores were in individual units. Further tests are in progress.

Mechanical Design and Layout for 256 x 256 Memory

(E. A. Guditz) (UNCLASSIFIED)

Two 64 x 64 modular planes have been constructed using conventional assembly methods. The connections on one have been dip soldered with satisfactory results. All of the module frames for the first 256 x 256 memory plane have been completed, and these will be wired as cores become available.

Final designs have not yet been accepted for either the memory mounting hardware or the new plug-in unit and mounting subrack. Proposed designs are being studied.

Memory Test Setup VI

(E. A. Guditz) (UNCLASSIFIED)

The tester is being modified so that single memory planes of any size up to 64 x 64 and any type construction can be plugged in and operated.

Printed Plane (E. A. Guditz) (UNCLASSIFIED)

Photographic and mechanical registration problems have been overcome, and 4 x 4 printed planes are being produced in sufficient quantity for experiments in dip soldering to proceed. Results to date are satisfactory.

Printed Wiring Committee

(E. A. Guditz) (UNCLASSIFIED)

A Lincoln Laboratory Printed Wiring Committee has been established as a subcommittee of the Lincoln Standards Committee with E. A. Guditz as Chairman. The Committee is dedicated to the advancement of printed-wiring techniques throughout the Laboratory. Questions or comments on the subject may be directed to E. A. Guditz.

Core Memory with External Selection

(S. Bradspies) (UNCLASSIFIED)

The thesis, for the Master of Science Degree, was delivered to the Electrical Engineering Department. It is entitled "A Magnetic-Core Memory With External Selection."

Memorandum 6M-3345

Page 47

Memory Plane With External Selection

(D. H. Ellis) (UNCLASSIFIED)

A test is in progress to determine the effect of high-speed switching on the output of a memory core.

Another test is being made to determine the optimum size of the switch and memory cores and the corresponding value of loop resistance. Within the next biweekly period, General Ceramics will provide us with cores of lower S_w . This should help solve the problem of excessively large driving currents.

Transistor Sense Amplifier

(F. W. Sarles) (UNCLASSIFIED)

I have been experimenting with transistor difference amplifiers, primarily using surface-barrier transistors. These amplifiers seem to be fairly satisfactory for amplifying 1- μ sec pulses. Delay time is less than 0.1 microsecond. Voltage gain per stage is about ten. The major problem encountered thus far has been d-c unbalance; feedback circuitry is being investigated as a possibility for counteracting this unbalance.

3.2.4 Systems3.2.4.1 Systems Design

(J. W. Forgie, N. L. Daggett) (UNCLASSIFIED)

We have been investigating a counter system which uses double-rank flip-flops but time-shares one rank so that only one row of noncomplementing flip-flops is required per counter. We investigated this primarily to make sure there is no easy way to avoid increasing the number of components in a double-rank system. Although this system does not require doubling the number of flip-flops, it needs too many additional gates to be worthwhile.

Memorandum 6M-3345

Page 48

IV - CENTRAL SERVICES

4.1 Material Requirements & Stock

(H. B. Morley) (UNCLASSIFIED)

Division 1 Stock Control has asked us to prepare inventory cost figures to include:

1. Cost of current inventory of Division 6 component stocks;
2. Cost of 1 year's supply of Division 6 standard components.

This work will be completed about 2 February.

4.2 Engineering Services

4.2.1 Components

(R. J. Biagiotti, H. W. Hodgdon, C. Morrione, B. B. Paine)
(UNCLASSIFIED)

Two members of the Components Section (Paine and Morrione) attended a RETMA Committee Meeting and the Symposium on Printed Circuits in Philadelphia on 19-21 January. A trip report will be written.

The tabulation of incoming inspection data on IBM cards has progressed to a point where it can be demonstrated that this is a practical method of extracting useful information from the data.

The equipment arrangement in the Components Section Laboratory has been changed again for more convenient use of available space.

4.2.2 Test Equipment

Test Equipment Headquarters

(A. Bille, L. Sutro) (UNCLASSIFIED)

The packaging of portable supplies to provide all laboratory voltages has been improved. In the past all of the laboratory voltages except +10-v have been supplied by a 250-lb Burroughs type 9101A. The +10-v has been supplied by a 25-lb P-1 supply. The combination made an awkward unit to move about. Now the P-1 will be dispensed with and the +10-v obtained from a bleeder across +90-v supply in the large unit.

Memorandum GM-3345

Page 49

4.2.3 Mechanical Engineering

(L. B. Smith, A. R. Smith, L. B. Prentice) (UNCLASSIFIED)

Jigs and fixtures have been developed which reduce the wiring time of a 64 x 64 memory plane from 30 hours to about 15. By properly improving techniques in the use of these aids, a 64 x 64 modular plane can be wired in one day.

4.2.4 Power

(R. Jahn) (UNCLASSIFIED)

The present a-c lab power for Room 10-397 at MIT is inadequate. New 30-amp lines will be installed during the next biweekly period.

4.3 Drafting

(A. M. Falcione) (UNCLASSIFIED)

There have been occasions when it would have been desirable to record and index some important magazine article, outside printed document, or letter, in much the same manner as our Memoranda and Reports are done. This method allows rapid identification and access to reproducible copies.

In order to incorporate such miscellaneous data as part of our official documents for future reference, a new numbering system is being established for this data, starting with Document #1. All data to be retained for access of Laboratory personnel will be turned in to Diana Helwig in the Document Room who will stamp each item in the upper right-hand corner with the following:

LL Div. 6
DR-#1

The article will be photographed for Multilith reproduction, and copies will be kept on file. This system will be especially useful for release of specifications for the duplex Central. An accessions list of miscellaneous documents will be issued periodically.

This subject will soon be covered in greater detail in a memorandum.

Memorandum 6M-3345

Page 50

4.4 Administration and Personnel

4.4.1 Staff

(J. C. Proctor) (UNCLASSIFIED)

John N. Ackley is a new staff member in Group 64. He will receive his BA from MIT in February of this year. Until recently he was employed as a part-time student by the Laboratory.

Howard Rundquist is a new staff member assigned to Group 64. He received his BA from Gustavus Adolphus College and has had 3 years' experience in the Navy.

4.4.2 Non-Staff

New Personnel

(R. A. Osborne) (UNCLASSIFIED)

Annabelle Eknoian and Harvey K. Segal are new members of the Drafting Department.

Paul Guinard has joined Group 61 as a Computer Operator.

Regina Murphy is a new secretary in Group 61.

Terminations

(R. A. Osborne) (UNCLASSIFIED)

Donald Dewey (Military Leave)

Pauline Cochary

Maureen Meade

George Smith (Military Leave)

Robert Sullivan

Open Requisitions

(R. A. Osborne) (UNCLASSIFIED)

1 Clerk Group 60

1 Electronic Layout Draftsman Group 60

Memorandum 6M-3345

Page 51

1 Ozalid Operator	Group 60
1 Clerk-Typist	Group 62
1 Multilith Operator	Group 60
1 Technical Assistant	Group 61

~~CONFIDENTIAL~~

Memorandum 6M-3345

Page 52

Accessions List

(D. B. Helwig) (CONFIDENTIAL)

The following documents were published by Division 6 or received from IBM during the period 17 - 21 January 1955:

Division 6 Reports

NO.	AUTHOR	TITLE	CIS.
6M-3247	R. Gould	Maintenance Planning for Duplex Central	U
6M-3251	S. Dodd	IBM Retrofit Program for AN/FSQ-7	U
6M-3252	N. Menyuk	Paramagnetic Behavior of Ferrites Containing Two Kinds of Magnetic Ions	U
6M-3261	R. Mayer et al.	Formation and Plans of the Logical Services Committee	C
6M-3280	E. Wolf	General Considerations of the Radar Data Input Problem with Applications to the 1954	C
6M-3287	- - -	Biweekly Report for 14 January 1955	C
6M-3302	J. C. Proctor	SAGE System Meeting, Jan. 17, 1955	U
6M-3304	W. Clark et al.	Announcement of Auxiliary Memory Meeting	U
6M-3305	H. Boyd	Proposed Changes for XD-1 Drum System	U
	A. Heineck		
6M-3306	C. Oudette	Proposal for XD-1 Utility Program	U
6M-3307	C. Watt	Air Force Joint Coordination Meeting at IBM on Jan. 13, 1955	U
6M-3308	R. Walquist	Installation Schedule for XD-1 Auxiliary and Situation Display Consoles	U
6M-3310	H. Kirshner	Ordering Procedure for XD-1 Telephone Service	U
6M-3312	K. McVicar	Lincoln-Proposed Schedule Modifications Covering 8-Month Period for Installation and Test of First Direction Center	C
6M-3314	A. Smalley	Group 61 Mission Specifications for Live Training Tests on 25 Jan. 1955	U
6M-3316	K. Olsen	Transistor Circuits for Driving Coincident Current Memories	U
6M-3317	W. Canty et al.	Evaluation Tests on the XD-1 Central Computer	U
6M-3318	A. Heineck	Proposed Changes for XD-1 Drum System, Part II	U
	H. Boyd		
6M-3319	H. Ziegler	Maintenance Testing of Duplex Pluggable Units	U
6M-3320	H. Benington et al.	Equipment Allocation and Layout for XD-1 Auxiliary Consoles and Wing Units	C
6M-3321	R. Davis	Monthly Operations Schedule (MOS) 2-55 for Feb.	C
6M-3323	W. Clark et al.	Results of Auxiliary Memory Meeting of 21 Jan.	U
6M-3324	D. Brown	SAGE System Meeting of Jan. 10, 1955	C
6M-3325	A. Smalley	Gp. 61 Mission Specifications (9-55) for Simulated Training Mission on 27 Jan. 1955	U
6M-3326	J. Crane et al.	Central Computer Evaluation, Feb. 14 - 28, 1955	U
6M-3327	D. Israel	Proposal for Documentation of Test Program Activity	C
6M-3332	S. Thompson	Central Computer Evaluation, Feb. 28 - March 11, 1955 (No. 2)	U

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~

UNCLASSIFIED

Memorandum 6M-3345

Page 53

Accessions List (Continued)IBM Documents

<u>NO.</u>	<u>AUTHOR</u>	<u>TITLE</u>	<u>CLS.</u>
IBM-675	M. Collins	Standard Pulse Switching Through Wire Contact Relays	U
IBM-676	J. Anderson	Description of the Flip-Flops to be Used in the Production Machine	U
IBM-677	R. Cunningham	Prototype Central Computer System-Logical, Unit and Drawing Nos.	U
IBM-678	- - -	AN/FSQ-7 Biweekly Progress Report	C
IBM-679	R. Cunningham	Prototype Drum System-Logical, Unit and Drawing Nos.	U
IBM-680	W. Rooney		
	J. Carlson	Marginal Checking Back Panel Wiring and Intermodule Cabling	U
IBM-681	R. Pfaff	Progress Report on Maintenance Programs	U
IBM-682	W. Slagle	The Missing Pulse Detector	U
IBM-683	- - -	AN/FSQ-7 Engineering Progress Report	S

NOTICE

In order to have central records on the IBM material available at Lincoln, it is requested that any documents received by any Division 6 staff be reported to the Document Room to be assigned a number. All that is requested is that D. Helwig, ext. 806, be notified upon receipt of IBM documents.

UNCLASSIFIED

~~CONFIDENTIAL~~